TPC distortions in tracking chain

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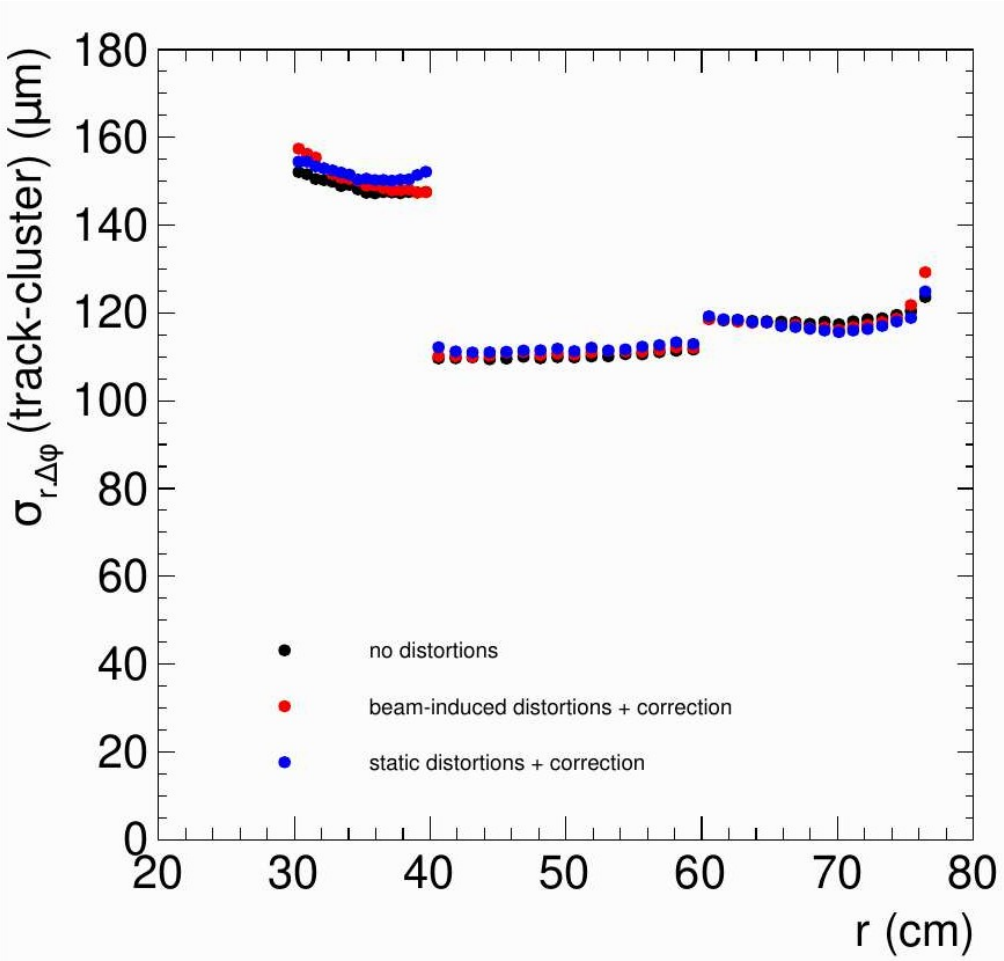
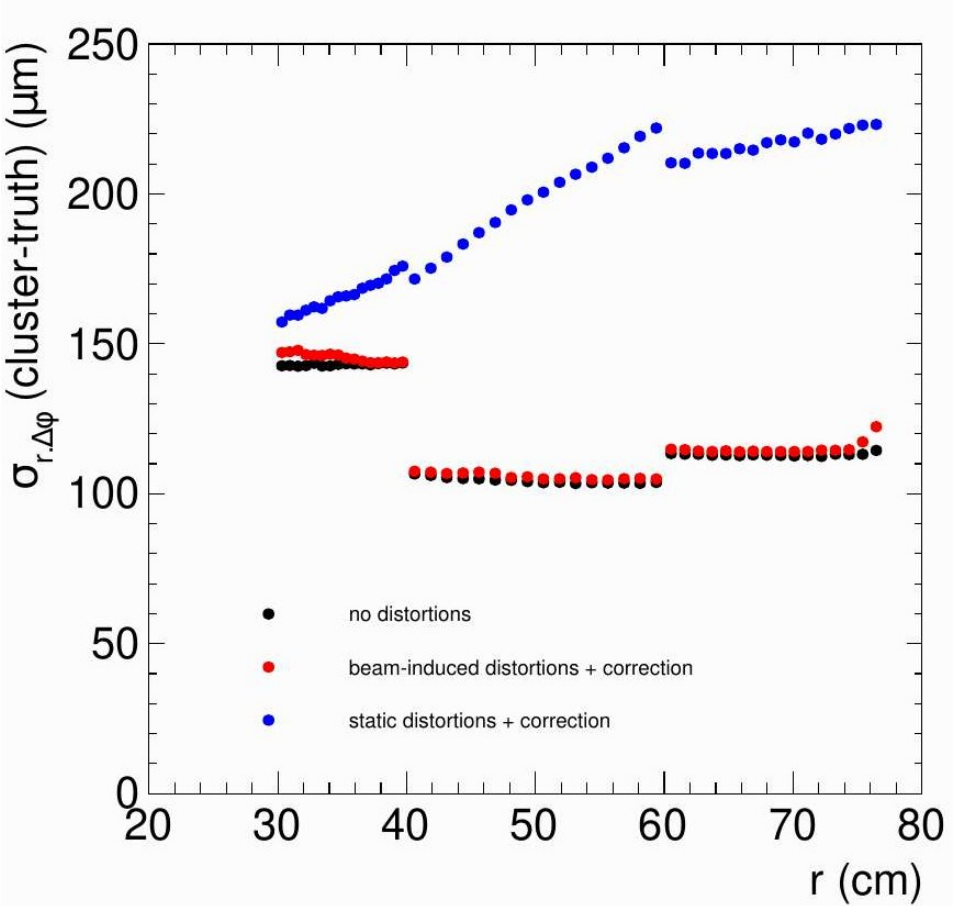
Residuals (track - clusters)



Residuals (track - clusters) show little difference betwen w/ and w/o distortions
Does not teach much though: even if clusters are poorly corrected, the fitted track might still go through them well.

Should rather look at cluster - truth (that characterizes cluster mover and distortion inversion)

Residuals (cluster-truth)

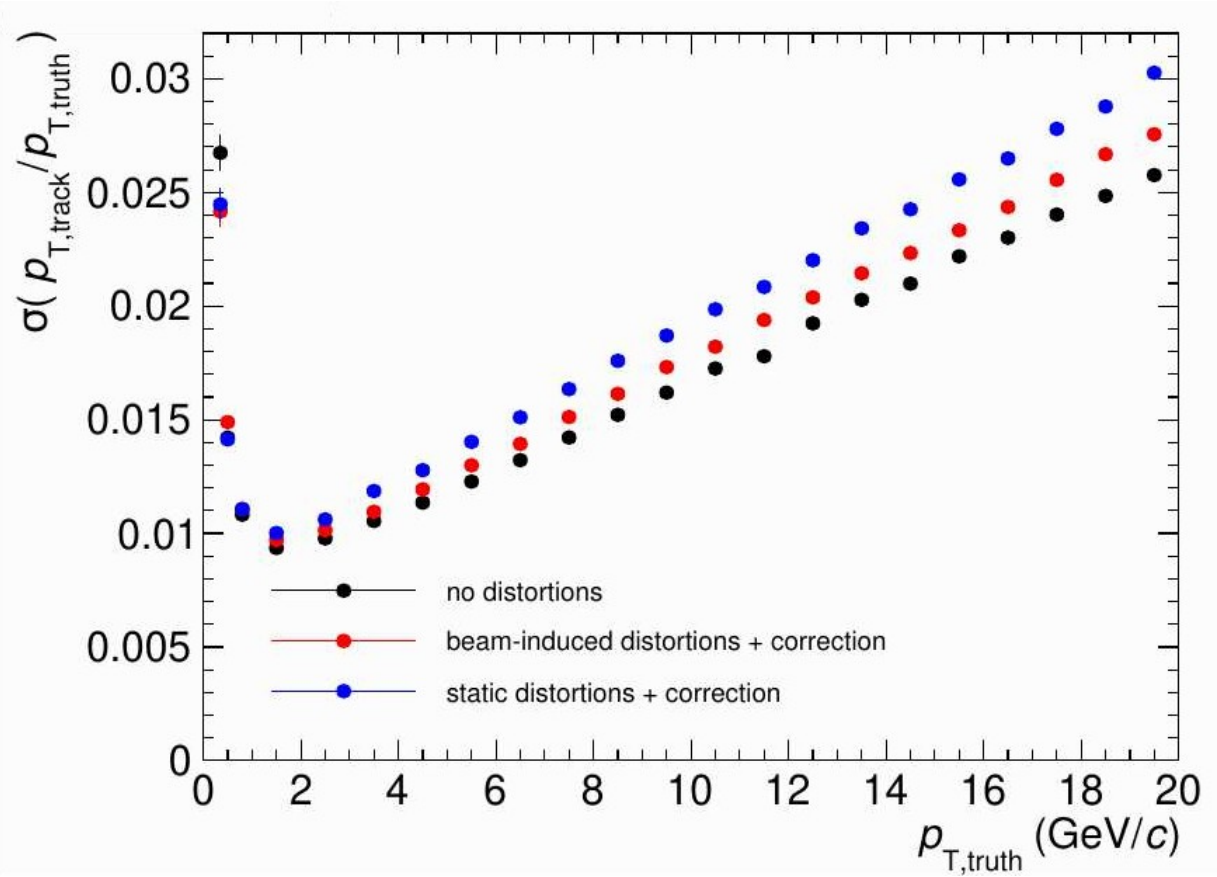


Would indicate that the culprit for the deterioration is either the cluster mover or the inverted distortion corrections

This is in contradiction with conclusion from slides 5 and 7 (truth track finding)

→ Need to investigate static distortion case further. In particular, I have two peaks in some residual distributions

Momentum resolution



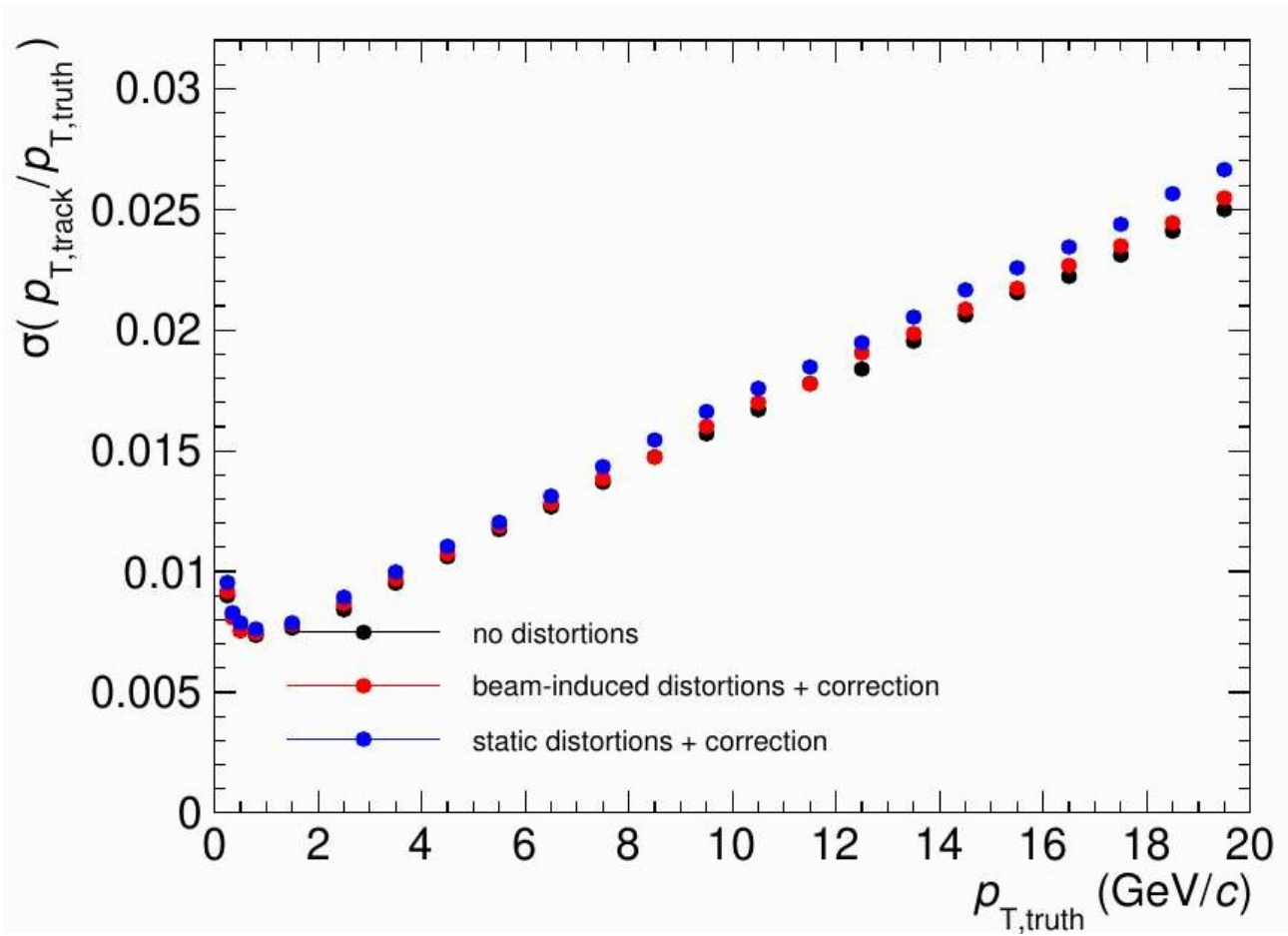
Input: high statistic samples of 400k pion events (one π^+ and one π^- per event)

Using full tracking

distortion correction uses truth distortion map, inverted

Added cut on $n_{clusters,mvtx} > 2$ on track selection, to match Tony

Momentum resolution (cont.)



Input: high statistic samples of 400k pion events (one π^+ and one π^- per event)

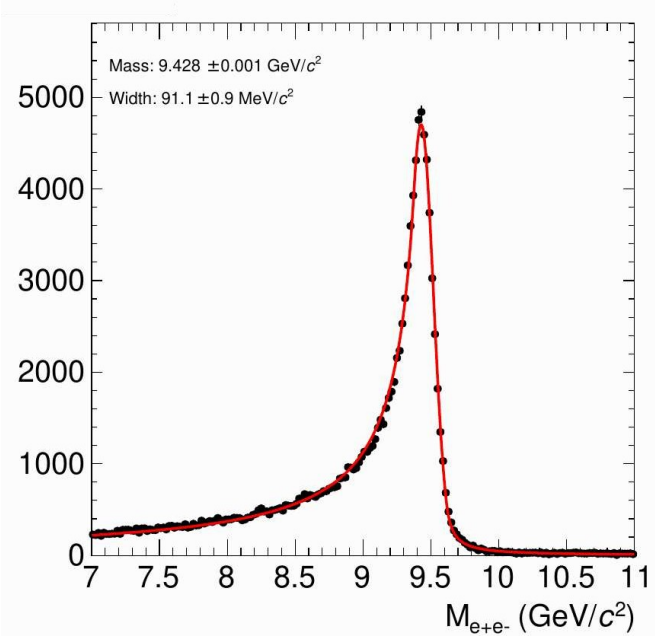
Using truth tracking

distortion correction uses truth distortion map, inverted

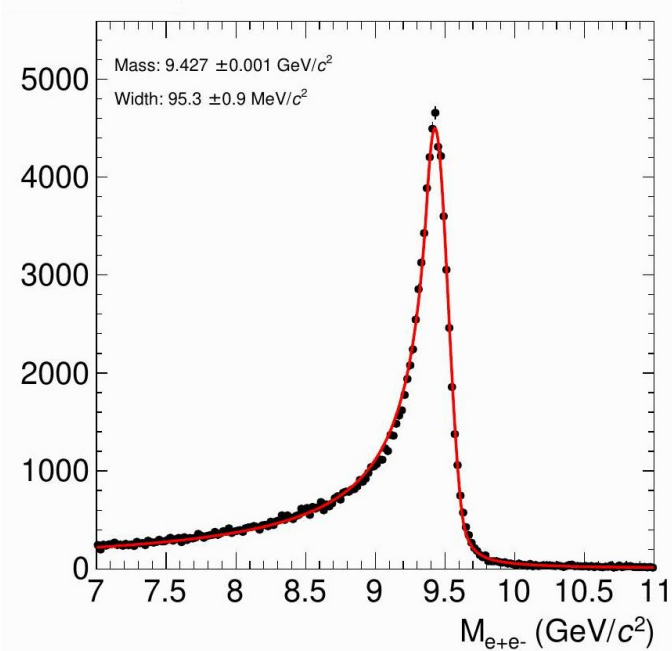
Added cut on $n_{clusters,mvtx} > 2$ on track selection, to match Tony

Much smaller differences between w/ and w/o distortions as with full tracking.

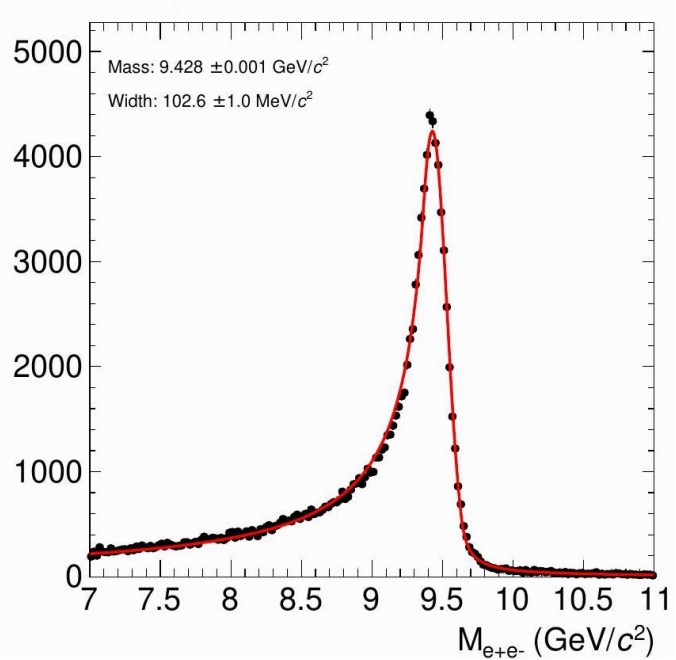
Upsilon invariant mass resolution



No distortions
σ = 91±1 MeV/c²



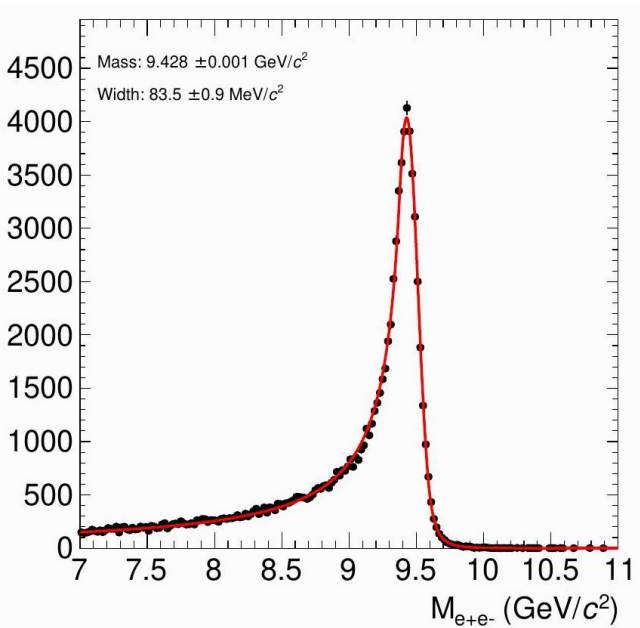
beam-induced distortions + correction
σ = 95±1 MeV/c²



Static distortions + correction
σ = 103±1 MeV/c²

Input: high statistic samples of 200k single upsilon events
Using full tracking
distortion correction uses truth distortion map, inverted

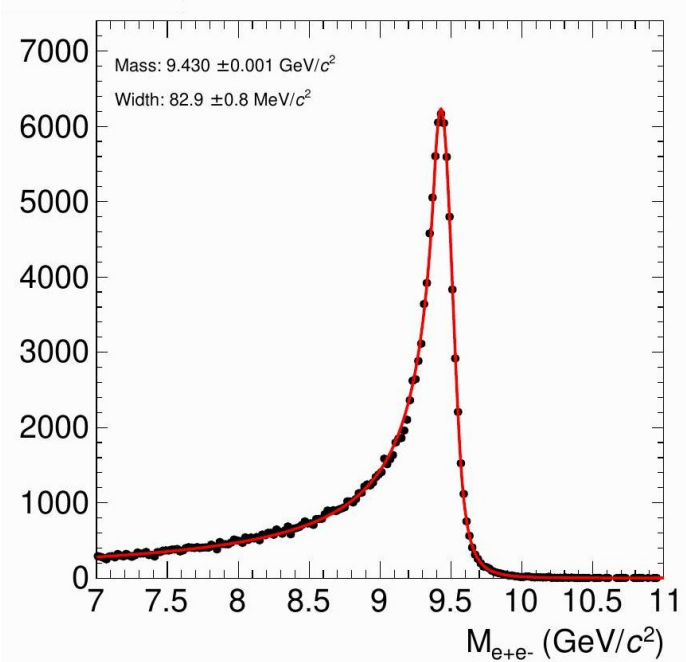
Upsilon invariant mass resolution (update)



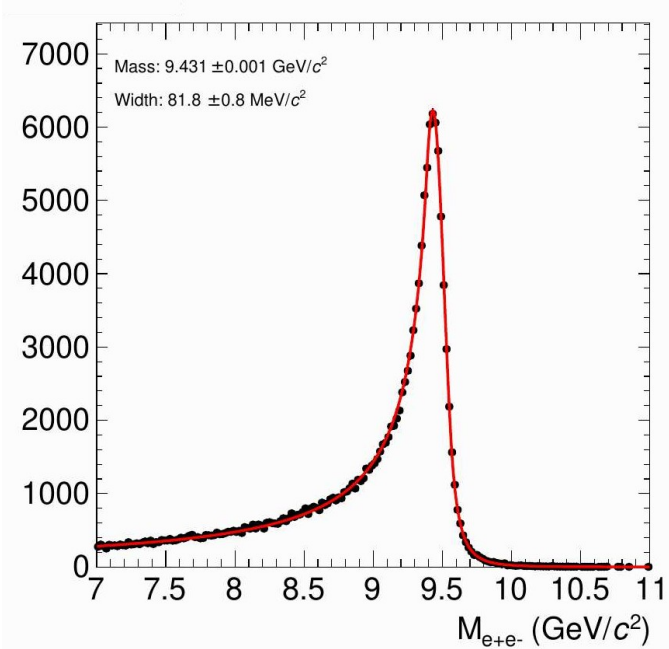
No distortions
σ = 83.5±0.9 MeV/c^2

Input: high statistic samples of 200k single upsilon events
Using cuts from Joe: ncluster_mvtx > 2, ncluster_tpc > 30
Using full tracking
distortion correction uses truth distortion map, inverted
Numbers now consistent with Joe

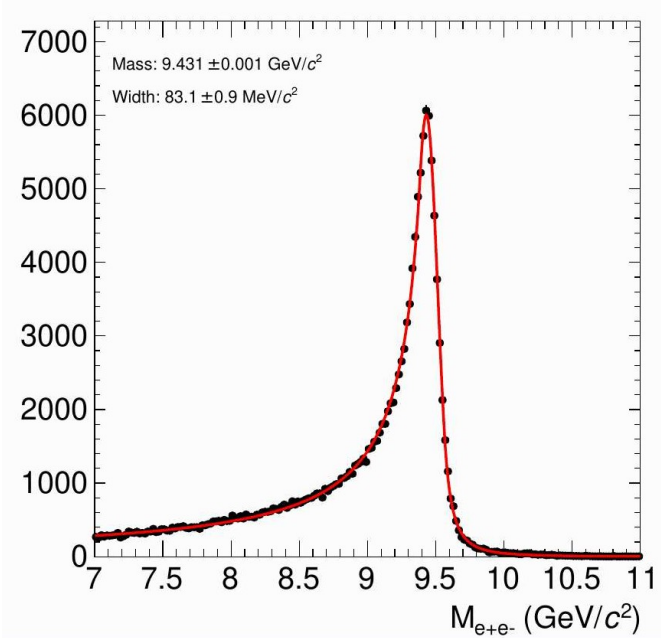
Upsilon invariant mass resolution



No distortions
σ = 83±1 MeV/c²



beam-induced distortions + correction
σ = 82±1 MeV/c²



Static distortions + correction
σ = 83±1 MeV/c²

Input: high statistic samples of 200k single upsilon events
Using truth tracking
distortion correction uses truth distortion map, inverted

Conclusion

There is some deterioration of the residual (track-cluster), momentum and invariant mass resolution when introducing distortions and truth-based distortion corrections in the tracking chain

The deterioration is larger for larger distortions (static = O(cm) vs beam-induced = O(mm))

It might come from

1) poorer seeding and initial track parameters

2) inexact cluster mover

3) approximate distortion corrections, from the inversion method

Redoing the same comparison but using truth track seeding in the TPC (G4TRACKING::use_full_truth_track_seeding = true;), one find much smaller differences between w/ and w/o differences.

Would indicate that 1) is the culprit